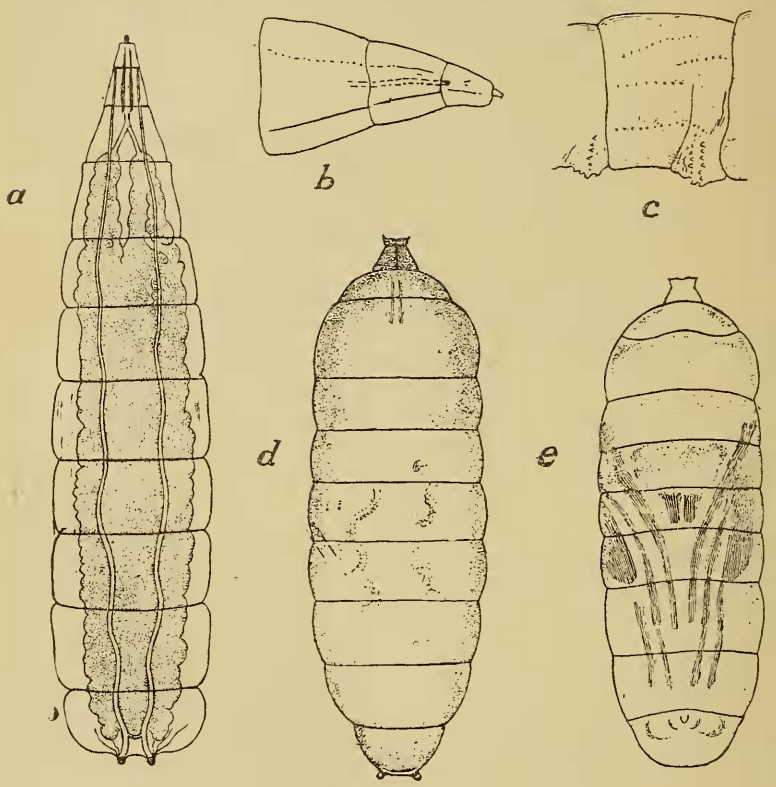
THE LARVAL STAGES OF LIMNOPHORA DISCRETA STEIN (DIPTERA, ANTHOMYIDAE).

By Werner Marchand, Ph.D.[1]

On October 31, 1918, while sifting for tabanid larvae at the White City Park pond of Trenton, New Jersey, the writer found a small whitish dipterous larva, unknown to him and of a type not figured in Malloch's paper. It may be briefly described as follows:

Description of Larva (Fig. 1, *a–c*).



[1] From the Department of Animal Pathology of the Rockefeller Institute for Medical Research, Princeton, N. J. The author resigned April, 1919. The publication of these notes was delayed as at the time I was unable to have the imago identified.

FIG. 1. Larval stages of *Limnophora discreta* Stein. (*a*), dorsal view of larva; (*b*), lateral view of first three segments of larva; (*c*), lateral view of one of the abdominal segments of the larva; (*d*), dorsal view of puparium; (*e*), ventral view of puparium, with imago developing within.

Measurements: 9 mm. long, 1½ mm. diameter. Color creamy white. Intestinal contents orange in color. Chitinous head-skeleton and the two respiratory tubercles at the posterior end dark brown. Body shape cylindrical, pointed anteriorly, rounded posteriorly. The posterior segments hardly decreasing in diameter towards the posterior end. The four anterior segments narrower, the first (prothoracic) segment very small. Twelfth segment fused with the eleventh and not clearly distinguishable. Owing to this fact and to the smallness of the first segment the larva may appear 10-segmented at first sight. Anterior segment in constant, active movement. Chitinous rods of mandibles nearly straight, dark brown, reaching to posterior border of second segment. Fat-body strongly developed, white, reaching from the eleventh into the third segment on both sides, completely enveloping the salivary glands and the intestine, but leaving the tracheae free on the dorsal side. Ventrally the fat-body envelops everything; in the middle of the body the orange color of the intestine is visible. Ducts of the salivary glands free, slender, uniting anteriorly near the posterior end of the chitinous rods. Malpighian vessels partly extending into segments six and seven, brownish anteriorly, whitish posteriorly. Cephalic ganglion large, brownish; ganglion chain highly concentrated; its total length only that of the cephalic ganglion. Tracheal trunks slender, of even length throughout, only gradually narrowing down anteriorly; describing broad and indistinct loops. Commissures not noticeable; if present on dorsal side, they must be very long as not to hinder the sidewise shifting of the tracheal trunks. Commissures posteriorly of pharynx very distinct; a second commissure in segment eleven likewise distinct, rather short and straight, holding the tracheae here fixed at a certain distance. Laterally very slender tracheal branches given off obliquely on each side. Anteriorly, the tracheal trunks end at the anterior border of the second segment, laterally on each side in a (rudimentary ?) anterior spiracle, similar to that found in *Chrysops* before pupation. Posteriorly, the tracheal trunks open separately in two short, cylindrical, brownish-black respiratory prominences, which are about three times their own diameter apart from one another.

Three more slender tracheae endling likewise in each of these tubercles.

Integument silky shining, with extremely fine, microscopical, parallel striation, which is more distinct on segments ten and eleven than in the anterior part of the body, where the integument is dull in appearance. The place of prolegs is taken by a transverse ventral swelling on each of the segments four to ten; each swelling armed with two rows of short, roundish spines or hooks. Areas of the integument fairly well demarcated on abdominal segments. Ventral areas as wide as the transverse swellings, on both sides of the latter demarcated from the lateral areas by a longitudinal row of about fifteen punctiform depressions. Lateral areas indistinctly differentiated into upper, middle and lower lateral areas by means of rows of punctiform depressions. Row of punctures separating middle and lower lateral area consisting of about seven punctures, beginning at posterior end of segment but not reaching anterior border. Row of depressions between middle and upper lateral area likewise consisting of five to seven punctures, beginning at anterior border of the segment but not reaching the posterior border. Row of depressions separating dorsal and lateral areas longer, comprising about eight to twelve punctures, beginning at posterior border of segment but not quite reaching the anterior border. All areas very finely and minutely striated. On segments four to ten the three lateral areas are thus demarcated. On the meso- and metathorax the lateral areas are undivided. Owing to the smallness of the prothoracic segment its structure could not be determined. On the meso- and metathorax the lower border of the lateral areas has more the character of a straight furrow; the upper border of a row of punctiform depressions homologous. No Graber's organ (of Tabanidae) could be seen in this larva.

On November 9 a second specimen of this larva was found in the same locality. This specimen did not differ from the one described except that the Malpighian vessels were better visible and wholly white, extending dorsally through the greater part of the body, and that the salivary glands were better visible, being of much greater diameter than the Malpighian vessels, but more grayish-transparent and partly enveloped in the fat-body. The intestinal contents were bright orange. This specimen remained orange in color, while the first-taken specimen was more of a lemon yellow. The two larvae were kept in test-tubes lined with moist filter paper; as food, boiled meat was given, but it could not be

ascertained whether any food was taken. The larvae were observed daily; they moved freely about in the test-tubes, being found at times near the bottom, at other times near the upper end, resting sometimes with head pointing downward, at other times pointing upward, while no preference for a particular resting attitude could be detected.

On November 20 both specimens had pupated, one of them undoubtedly on the same day, since it was still pale in color, the second specimen either early on the same day or on the preceding day. Pupation takes place within the larval skin, the result being a puparium. No cocoon is formed.

Description of Puparium (Fig. 1, *d–e*).

Length 5 mm., diameter 1½ mm. Color yellowish-fuscous, at first pale, then darker reddish. In the fresh pupa dark mouth-parts and pale Malpighian vessels shining through the integument, the passive movements of the latter plainly visible. Integument of mature puparium not transparent; surface generally reticulate in structure. Body twelve-segmented; segment one short, consisting of two roundish swellings at the anterior extremity of the body, bearing the two small, whitish cylindrical anterior spiracles. Segment two narrow, wider posteriorly, at base only one-half as wide as segment three, brown, rugose, with a dorsal, ventral and lateral ridge, the latter continued upon the third segment. Third segment with posterior border twice as wide as anterior, broadly convex, evenly rounded; surface with fine chitinous ridges in a reticulate arrangement. Fourth segment of still greater diameter, rounded, areolate. Border between the segments rugose, with areolae smaller and less distinct. Following (fifth) segment not wider than fourth; surface areolate; following six abdominal segments at first wider than preceding, posterior ones gradually narrower; sixth of these segments (eighth abdominal = eleventh body segment) about one-half as wide as first (third abdominal). Last or twelfth body segment small, short, flat, placed somewhat ventrally, distinctly separate from eleventh segment, with two divergent black spiracular processes. Spiracular processes short-cylindrical, rounded at tip, compressed laterally; placed at a distance of about three times their own diameter from one another. All abdominal segments except twelfth distinctly areolated; border lines of segments with areolae indistinct or reduced to wrinkles. Borders of segments slightly constricted. Ventral side more evenly rounded, surface areolated like dorsal. A pale rounded spot

ventrolaterally at posterior border of segment four. A median ridge ventrally of segment two. Lateral ridge on segment two continued on segment three and disappearing in the areolated surface structure of segment four. Areolate structure of integument of a polyhedral character on thorax; reticulae (meshes) more flattened out transversely on abdomen, especially on dorsal side.

The two puparia were placed in a Petri dish containing algae and some moist filter paper and covered with a glass slide. On November 29 both puparia had assumed a darker color, wings, legs, and mouth-parts becoming visible through the integument. The first imago hatched November 30; the second was found hatched on December 2, and it had probably emerged the day before. These two flies have been kindly identified by Mr. J. R. Malloch as belonging to *Limnophora discreta* Stein, a species of which the life-history was thus far unknown.

ORTHOCEPHALUS MUTABILIS FALL. (HEMIP., MIRIDAE).

By J. R. Stear, Penna. Bur. of Plant Industry, Harrisburg, Pa.

Numerous specimens of this species, including nymphs in all stages as well as adults, were collected at Orono, Maine, by Mr. and Mrs. Robt. J. Sim, on June 15, 1922. They were determined for me by Prof. H. H. Knight, of the University of Minnesota.

They were taken on ox-eye daisy (*Chrysanthemum leucanthemum*), which was noticeably injured by the feeding of the Mirid, the plants being undersized and poorly developed. In an adjoining field not infested the daisies were normal in size.

It is interesting to note that *O. mutabilis* is an European species, where it has been known for over a hundred years. The only other reference to this species in American literature is that by Knight, in Can. Ent., Vol. 49, p. 249, who states that specimens were taken July 2, 1913, by C. W. Woods at Orono, Me. Mr. Woods found them on "wild daisy" and in only one field.